

U.S. Patent Application Serial No. 09/321,605
Amendment Under 37 C.F.R. §1.111 dated August 21, 2003
Reply to Office Action of May 21, 2003

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (Currently Amended): A method of manufacturing a semiconductor device comprising the steps of :

forming a couple of impurity diffusion layers in a semiconductor substrate;

forming a first insulating film covering the semiconductor substrate;

forming a lower electrode of a capacitor on the first insulating film;

forming an oxide dielectric film of the capacitor on the lower electrode;

forming an upper electrode of the capacitor on the oxide dielectric film;

forming a second insulating film for covering the capacitor;

forming a first opening for electrically connecting one of the couple of impurity diffusion layers and a second opening which exposes the upper electrode in the first and second insulating films, by etching a part of the second insulating film and a part of the first insulating film;

forming a metal film on the second insulating film for electrically connecting the one of the couple of impurity diffusion layers via the first opening and the upper electrode via the second opening, the metal film made of a member of the group consisting of a titanium nitride, a tungsten nitride, and titanium tungsten nitride;

forming a local interconnection covering an entire portion of the upper electrode with an area which is larger than an area where the upper electrode contacts with the oxide dielectric film in a

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plan view, the entire portion being with respect to a width and a length of the upper electrode, in a range which passes through the first opening and the second opening, by patterning the metal film;

forming a third insulating film for covering the local interconnection;

forming a third opening for electrically connecting to the other of the couple of impurity diffusion layers, by etching a part of the third insulating film; and

forming a wiring electrically connecting to the other of the couple of impurity diffusion layers, ~~the wiring composed from multi-layer films, the wiring having lower resistance than the local interconnection.~~

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Claim 2 (Previously Presented): A method of manufacturing a semiconductor device according to claim 1, wherein a metal film constituting the local interconnection is formed of metal nitride.

Claim 3 (Original): A method of manufacturing a semiconductor device according to claim 2, wherein the metal nitride is one of titanium nitride, tungsten nitride or titanium-tungsten nitride.

Claim 4 (Withdrawn): A method of manufacturing a semiconductor device according to claim 1, wherein the step of forming the capacitor comprises the steps of,
setting the upper electrode into a size which defines a capacitor region by patterning the upper electrode,

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leaving the oxide dielectric film at least below the upper electrode by patterning the oxide dielectric film, and

setting the lower electrode into a size which is wider than the oxide dielectric film by patterning the lower electrode.

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Claim 5 (Withdrawn): A method of manufacturing a semiconductor device according to claim 1, wherein the step of forming the capacitor comprises the steps of,

patterning the oxide dielectric film and the lower electrode,

forming an intermediate insulating film for covering the oxide dielectric film and the lower electrode,

forming a window, which is employed to define the capacitor region, in the intermediate insulating film by patterning the intermediate insulating film, and

forming the upper electrode at least in the window.

Claim 6 (Original): A method of manufacturing a semiconductor device according to claim 1, wherein the second insulating film for covering the capacitor or the third insulating film is a silicon oxide film which is formed by using silane.

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Claim 7 (Original): A method of manufacturing a semiconductor device according to claim 1, wherein the second insulating film is a silicon oxide film which is formed by using organic silicon compound source.

Claim 8 (Original): A method of manufacturing a semiconductor device according to claim 7, wherein the organic silicon compound source is tetra ethoxy silane.

Claim 9 (Previously Presented): A method of manufacturing a semiconductor device according to claim 1, wherein the oxide dielectric film is oxygen-annealed before or after the upper electrode of the capacitor is formed.

Claim 10 (Original): A method of manufacturing a semiconductor device according to claim 1, further comprising the step of oxygen-annealing the oxide dielectric film via the second opening and the upper electrode after forming the second opening.

Claim 11 (Previously Presented): A method of manufacturing a semiconductor device according to claim 1, wherein an upper electrode is formed of a noble metal or a conductive ceramic which is not oxidized by the oxygen-annealing.

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Claim 12 (Original): A method of manufacturing a semiconductor device according to claim 11, the noble metal is one of platinum, iridium or ruthenium.

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Claim 13 (Original): A method of manufacturing a semiconductor device according to claim 1, wherein the oxide dielectric film is formed of PLZT, PZT, $(\text{Ba},\text{Sr})\text{TiO}_3$, $\text{Pb}(\text{Zr},\text{Ti})\text{O}_3$, $(\text{Pb},\text{La})(\text{Zr},\text{Ti})\text{O}_3$, $\text{SrBi}_2\text{Ta}_2\text{O}_9$ or Ta_2O_3 .

Claim 14 (Previously Presented): A method of manufacturing a semiconductor device according to claim 1 further comprising the step of:

forming a conductive plug between the metal film and one of the couple of impurity diffusion layers in the first opening.

Claim 15 (Original): A method of manufacturing a semiconductor device according to claim 14, wherein the conductive plug is formed of tungsten.

Claim 16 (Previously Presented): A method of manufacturing a semiconductor device according to claim 1, wherein one of the couple of impurity diffusion layers is a component part of an MOS transistor.

Claim 17 (Withdrawn): A semiconductor device comprising:

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an impurity diffusion layer formed on a semiconductor substrate; a first insulating film for covering the impurity diffusion layer and a semiconductor substrate; a capacitor formed on the first insulating film and consisting of a lower electrode, an oxide dielectric film, and an upper electrode; a second insulating film for covering the capacitor; first and second openings formed in the second insulating film to on or above the impurity diffusion layer and the upper electrode; a local interconnection connected electrically with the impurity diffusion layer and the upper electrode respectively through the first and second openings and formed on the second insulating film in a range containing at least a region where the upper electrode contacts the oxide dielectric film; and a third insulating film for covering the local interconnection.

Claim 18 (Withdrawn): A semiconductor device according to claim 17 further comprising, a conducting plug formed between the impurity diffusion layer and the upper electrode in the first opening.

Claim 19 (Withdrawn): A semiconductor device according to claim 17, wherein the local interconnection is composed of metal nitride.

Claim 20 (Withdrawn): A semiconductor device according to claim 19, wherein the metal nitride is one of titanium nitride, tungsten nitride or titanium-tungsten nitride.

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Claim 21 (Currently Amended): A method of manufacturing a semiconductor device comprising the steps of :

forming a couple of impurity diffusion layers in a semiconductor substrate;

forming a first insulating film covering the semiconductor substrate;

forming a lower electrode of a capacitor on the first insulating film;

forming an oxide dielectric film of the capacitor on the lower electrode;

forming an upper electrode of the capacitor on the oxide dielectric film;

forming a second insulating film for covering the capacitor;

forming a first opening for electrically connecting one of the couple of impurity diffusion layers and a second opening which exposes the upper electrode in the first and second insulating films, by etching a part of the second insulating film and a part of the first insulating film;

forming a metal film on the second insulating film for electrically connecting the one of the couple of impurity diffusion layers via the first opening and the upper electrode via the second opening, the metal film made of a member of the group consisting of a titanium nitride, a tungsten nitride, and titanium tungsten nitride;

forming a local interconnection covering an entire portion of the upper electrode with an area which is larger than an area where the upper electrode contacts with the oxide dielectric film in a plan view, the entire portion being with respect to a width and a length of the upper electrode, in a range which passes through the first opening and the second opening, by patterning the metal film,

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wherein the local interconnection is a blocking layer for preventing a diffusion of a redundant to the oxide dielectric film;

forming a third insulating film for covering the local interconnection;

forming a third opening for electrically connecting to the other of the couple of impurity diffusion layers, by etching a part of the third insulating film; and

forming a wiring electrically connecting to the other of the couple of impurity diffusion layers, ~~the wiring composed from multi-layer films, the wiring having lower resistance than the local interconnection.~~

Claim 22 (Previously Presented) A method of manufacturing a semiconductor device according to claim 1, wherein the local interconnection is formed with surrounding and protruding portions having a fixed size from edges of the area where the upper electrode contacts with the oxide dielectric film.